IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Moungi G. Bawendi et al.
Serial No. : 10/632,922
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Title : INVENTORY CONTROL

Art Unit : 1635
Examiner : James Schultz

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BRIEF ON APPEAL

Appellant is appealing the rejection of claims 1-3, 12-13, 26-27, 31-33, and 37-39 dated November 15, 2006. A Notice of Appeal was filed on December 18, 2006. A Notice of Panel Decision from Pre-Appeal Brief Review was mailed February 7, 2007. Appellant requests that the rejection of claims 1-3, 12-13, 26-27, 31-33, and 37-39 be reversed.

(i) Real Party in Interest

The real party in interest is Massachusetts Institute of Technology, the assignee of the above-captioned application.

(ii) Related Appeals and Interferences

There are no related appeals or interferences.

(iii) Status of Claims

Claims 1-3, 12-13, 26-27, 31-33, and 37-39 are pending and are being appealed. Claims 1, 26, and 37 are in independent form.

(iv) Status of Amendments

No amendments were made to the claims subsequent to the rejection mailed July 17, 2006.

(v) Summary of Claimed Subject Matter

Claim 1 relates to a library of compounds, wherein each compound in the library is bound to an individual support, each support having associated therewith more than one population of semiconductor nanocrystals, each population having a distinct characteristic spectral emission. See page 7, lines 11-14 of the specification. Each nanocrystal includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof. See page 9, line 28 to page 10, line 3 of the specification.

Claim 26 relates to a chemical library comprising a plurality of member chemicals, wherein each member chemical is bound to a support, each support having associated therewith more than one population of semiconductor nanocrystals, each population having a distinct characteristic spectral emission. See page 7, lines 16-20 of the specification. Each nanocrystal includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof. See page 9, line 28 to page 10, line 3 of the specification.

Claim 37 relates to a library of polypeptides comprising a plurality of polypeptides, wherein each polypeptide in the library is bound to an individual support, each support having associated therewith more population of semiconductor nanocrystals, each population having a distinct characteristic spectral emission. See page 27, line 9-14 of the specification. Each nanocrystal comprises a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof. See page 9, line 28 to page 10, line 3 of the specification.

(vi) Grounds of Rejection to be Reviewed on Appeal

1. Whether claims 1-3, 12-13, 26-27, 31-33, and 37-39 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 5,674,698 to Zarling et al. ("Zarling").
2. Whether claims 1-3, 12-13, 26-27, 31-33, and 37-39 are indefinite under 35 U.S.C. § 112, second paragraph.
3. Whether claims 1-3, 12-13, 26-27, 31-33, and 37-39 are obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 5,770,358 to Dower et al. ("Dower") in view of Zarling.

(vii) Arguments

1. Whether claims 1-3, 12-13, 26-27, 31-33, and 37-39 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 5,674,698 to Zarling.

The Examiner has maintained the rejection of claims 1-3, 12, 13, 26, 27, 31-33, and 37-39 under 35 U.S.C. §102(b) as being anticipated by Zarling. See Advisory Action dated November 15, 2006 ("Advisory Action") at page 2 and Office Action dated July 17, 2006 ("Office Action") at pages 4-8. Claims 1, 26 and 37 are independent claims.

Claims 1 and 26 relate to a library of compounds, or chemical library, wherein each compound or member chemical in the library is bound to an individual support; a chemical library that includes a plurality of member chemicals, wherein each member chemical is bound to a support; and a library of polypeptides that includes a plurality of polypeptides, wherein each polypeptide in the library is bound to an individual support. Each support has associated therewith more than one population of semiconductor nanocrystals. Each population has a distinct characteristic spectral emission. Each nanocrystal includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, or an alloy thereof, or a mixture thereof. Claim 37 relates to a library of polypeptides including a plurality of polypeptides, wherein each polypeptide in the library is bound to an individual support, each support having associated therewith more population of semiconductor nanocrystals, each population having a distinct characteristic spectral emission. Each nanocrystal includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof.

The Examiner maintains the position that Zarling discloses an "up-converting phosphor particle compris[ing] a host material (refers to the instant claimed shell layer overcoating the core) doped with an absorber and the emitting center (refers to instant claimed core) such that the combination of host material, absorber, and emitter produces distinct emission spectra (refers to instant claimed functional property of the nanocrystal ...." See Office Action at page 5. Applicants respectfully disagree.

Zarling discloses "labels, detection methods and detection apparatus which permit ultrasensitive detection of cells, biological macromolecules, and other analytes, which can be

used for multiple target detection and target discrimination." See col. 5, lines 23-26. Specifically, Zarling discloses the use of "fluorescent labels that are excited by an excitation wavelength and subsequently emit electro magnetic radiation at up-shifted frequencies." See col. 12, lines 56-59. The emitting center and the absorber described in Zarling is not a semiconductor nanocrystal core overcoated by a semiconductor shell. See col. 14, lines 15-50. Zarling does not describe a nanocrystal that includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, or an alloy or a mixture thereof. See independent claims 1, 26 and 37.

i. Group II-VI, Group III-V and Group IV Semiconductors. At page 3 of the Advisory Action, the Examiner contends that "the scope of the claimed 'nanocrystal' would encompass any 'semiconductor' members of group II thru group VI (group II-VI) of the chemical periodic table." The Examiner does not appear to recognize the simple language of the claims. The phrase "Group III-V semiconductor," is common nomenclature familiar to those of skill in the art that refers to a binary semiconductor including Group III element and a Group V element. Contrary to the contentions expressed in the Advisory Action, the phrase does not set forth a range; it does not indicate that the semiconductor can include an element from any of Groups III, IV, or V. For example, the specification lists some examples of Group III-V semiconductors at page 10, lines 1-3: "GaN, GaP, GaAs, GaSb, InN, InP, InAs, InSb, AlAs, AlP, AlSb." Each example in the list includes a group III element (Ga, In, Al) and a group V element (N, P, As, Sb) but no others. Ytterbium and Erbium are not Group III-V semiconductors. Nor are any of the other materials described in Zarling as the absorber and the emitting center (see, e.g., Zarling at column 16, Table 1). Indeed, none of the materials described in Zarling as the absorber and the emitting center are a Group II-VI semiconductor, a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof.

Furthermore, the Examiner refers to the definition of semiconductor material at page 9, lines 28-29 of the specification as evidence that other materials are not excluded. See Advisory Action at page 3. Specifically, the Examiner refers to a statement in the specification that "the core and/or the shell can be a semiconductor material including, but not limited to, those of the group II-VI (ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, HgS, HgSe, HgTe, MgTe and the like) . . . ." The Examiner contends that the phrase "but not limited to" suggests that other materials are not

excluded. See Advisory Action at page 3. The Examiner's reading of the specification is misplaced because the phrase "but not limited to" refers to the broader definition of "semiconductor material" not to group II-VI, group III-V, or group IV semiconductor materials. Each of the examples of group II-VI, group III-V, or group IV semiconductor materials, provided in the specification is consistent with the meaning of the respective phrases discussed above and is consistent with the ordinary meaning of group II-VI, group III-V, or group IV semiconductor materials. See, e.g., U.S. Patent No. 7,161,173 to Burgener et al., entitled "p-type group II-VI semiconductor compounds" (stating that a group II-VI semiconductor includes atoms of group II elements and atoms of group VI elements). The Examiner has yet to point to any definition of group II-VI, group III-V, or group IV semiconductor materials, whether in the specification or in the prior art, that is inconsistent with Applicants' use of the phrases.

For at least this reason, independent claims 1, 26 and 37 and the claims that depend from them are patentable over Zarling. Applicants respectfully request reconsideration and withdrawal of this ground of rejection.

ii. Core/Shell. Claims 2, 31 and 38 (which depend from claims 1, 26 and 37, respectively) each recite a nanocrystal that includes **a core including a first semiconductor material and a shell layer overcoating the core**, the shell including a second semiconductor material having a band gap greater than that of the core.

At page 4 of the Advisory Action, the Examiner argues that in Zarling "the center (core) has a shell layer (host materials)." As explained before, there is no reference in Zarling to a nanocrystal or a nanocrystal including a core and a shell layer overcoating the core. There is nothing in Zarling that indicates that the host material can be a layer.

The emitting center and the absorber described in Zarling, whether viewed separately or together, are not a semiconductor nanocrystal core. As the specification describes, a semiconductor nanocrystal core is itself a semiconductor nanocrystal. At pages 16-17 of the specification, the relationship between the semiconductor nanocrystal core and its overcoating is described, stating that "the surface of the semiconductor nanocrystal [core] is . . . modified to enhance the efficiency of the emissions, by adding an overcoating layer [(the shell)] to the semiconductor nanocrystal. . . . Suitable materials for the overcoating layer include semiconductors having a band gap energy than the semiconductor nanocrystal [core]." Zarling

does not disclose that the emitting center and the absorber (which is alleged to be equivalent to the claimed core) is a semiconductor nanocrystal. Zarling simply describes that "[g]enerally, the absorber is ytterbium and the emitting center can be selected from: erbium, holmium, terbium, and thulium; however, other up-converting phosphors of the invention may contain other absorbers and/or emitters." (Zarling at column 14, lines 33-37).

For at least this additional reason, claims 2, 31 and 38 are patentable over Zarling. Applicants respectfully request reconsideration and withdrawal of this ground of rejection.

iii. Band Gap. Claims 2, 31 and 38 (which depend from claims 1, 26 and 37, respectively) each recite a nanocrystal that includes a core including a first semiconductor material and a shell layer overcoating the core, the shell including a second semiconductor material **having a band gap greater than that of the core**.

Zarling does not describe a band gap of the shell semiconductor material is greater that of a core. Zarling merely provides a list of exemplary materials for the host material, the absorber, and the emitting center, but does not discuss their band gaps, or otherwise indicate that a particular relationship between the band gaps can be desirable.

For at least this additional reason, claims 2, 31 and 38 are patentable over Zarling. Applicants respectfully request reconsideration and withdrawal of this ground of rejection.

As demonstrated above, independent claims 1, 26 and 37 and the claims that depend from them are not anticipated by Zarling. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b).

2. Whether claims 1-3, 12-13, 26-27, 31-33, and 37-39 are indefinite under 35 U.S.C. § 112, second paragraph.

The Examiner has rejected claims 1-3, 12, 13, 26, 27, 31-33, and 37-39 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically the Examiner contends that independent "claims 1, 26 and 37 recites the broad recitation of 'Group II-VI semiconductor', and the claim also recites 'Group III-V semiconductor' [sic] and 'Group IV semiconductor' which is the narrower statement of the range/limitation." See the Office Action at page 9. Applicants respectfully disagree.

As discussed above, the phrase "Group II-VI semiconductor" does not set forth a range. The phrase does not indicate a semiconductor that includes an element of any of Groups II, III, VI, V, or VI. Rather, "Group II-VI semiconductor" refers to a binary semiconductor that includes both a Group II element and a Group VI element. This terminology is common and is readily understood by a person of skill in the art. The same is true for the phrase "Group III-V semiconductor," which refers to a binary semiconductor including both a Group III element and a Group V element, and not to a semiconductor including elements from any of Groups III, IV, or V.

The specification is consistent with this usage of "II-VI" and "III-V." At page 9, line 28-page 10, line 3, exemplary semiconductor materials are discussed:

> The core and/or the shell can be a semiconductor material including, but not limited to, those of group II-VI (ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, HgS, HgTe, MgTe and the like) and III-V (GaN, GaP, GaAs, InN, InP, InAs, InSb, AlAs, AlP, AlSb, AlS, and the like) and IV (Ge, Si, Pb, and the like) materials, and an alloy thereof, or a mixture thereof.

Each exemplary group II-VI semiconductor material includes a group II element (Zn, Cd, Hg, Mg) and a group VI element (S, Se, Te); each group III-V semiconductor material includes a group III element (Ga, In, Al) and a group V element (N, P, As, Sb); and each group IV semiconductor material includes a group IV element (Ge, Si, Pb). No group III, IV, or V elements appear in the list for group II-VI semiconductor materials and no group IV elements appear in the list of group III-V elements, as would be expected from the ordinary usage of "Group II-VI semiconductor" and "Group III-V semiconductor."

Because a person of ordinary skill in the art would understand that the phrases "Group II-VI semiconductor," and "Group III-V semiconductor," do not set forth ranges but refer to binary semiconductors including elements of Groups II and VI, or Groups III and V, respectively, the claims are not indefinite. Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph.

3. Whether claims 1-3, 12-13, 26-27, 31-33, and 37-39 are obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 5,770,358 to Dower in view of Zarling.

The Examiner has rejected claims 1-3, 12, 13, 26, 27, 31-33, and 37-39 under 35 U.S.C. § 103(a) as being unpatentable over Dower in view of Zarling. See Advisory Action at page 2 and Office Action at pages 10-13. Claims 1, 26 and 37 are independent.

The Examiner acknowledges that Dower does not teach semiconductor nanocrystals at all ("The libraries of Dower et al. differ from the presently claimed invention by failing to include semiconductor nanocrystal labels.") (Office Action at 10). Zarling does not remedy this defect. As discussed above, Zarling fails to teach all the limitations of independent claims 1, 26 and 37, and the claims that depend from them. Specifically, Zarling does not teach a nanocrystal that includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof. Nor does Zarling teach a nanocrystal that includes a core including a first semiconductor material and a shell layer overcoating the core, the shell including a second semiconductor material having a band gap greater than that of the core.

Moreover, a person of skill in the art reading the teachings of Zarling would not be motivated to use the phosphor particles described therein in the libraries of Dower. Indeed, Dower did not contemplate using any type of inorganic label in a library. Zarling was seeking an alternative to radioisotopes. Neither of these references provide any teaching, suggestion or motivation to use the particles of Zarling in the libraries of Dower. Even if they did, Applicants' claims 1, 26 and 37 are patentable for at least the reason that a nanocrystal that includes a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof is not described or suggested by either Dower or Zarling.

Neither Dower, Zarling, nor their combination teaches all the limitations of claims 1, 26, and 37. Thus, independent claims 1, 26 and 37 and the claims that depend from them are not obvious over Dower in view of Zarling. Applicants respectfully request reconsideration and withdrawal of under 35 U.S.C. § 103(a).

CONCLUSION

In light of the foregoing arguments, Applicants respectfully request that the rejection of all claims be reversed. The Commissioner is authorized to charge $500 to Deposit Account 19-4293 for the appeal brief fee. Should any further fees be required or credits made, please use Deposit Account 19-4293.

Respectfully submitted,

Date: 5-7-07

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(viii) Claims Appendix

1. A library of compounds, wherein each compound in the library is bound to an individual support, each support having associated therewith more than one population of semiconductor nanocrystals, each population having a distinct characteristic spectral emission,

wherein each nanocrystal comprises a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof.

2. The library of claim 1, wherein each nanocrystal member comprises:

a core comprising a first semiconductor material; and

a shell layer overcoating the core, the shell comprising a second semiconductor material having a band gap greater than that of the core,

wherein the first semiconductor material and the second semiconductor material are the same or different.

3. The library of claim 1, wherein the characteristic spectral emission is a wavelength of emitted light, an intensity of emitted light, or both a wavelength and an intensity of emitted light.

Claims 4-11. (Canceled)

12. The library of claim 1, wherein each individual support is a bead, a pellet, a disk, a capillary, a hollow fiber, a needle, a solid fiber, a cellulose bead, a pore-glass bead, a silica gel,

a polystyrene beads optionally cross-linked with divinylbenzene, a grafted co-poly bead, a poly-acrylamide bead, a latex bead, a dimethylacrylamide bead optionally cross-linked with N,N'-bis-acryloyl ethylene diamine, a glass particle coated with a hydrophobic polymer, or a low molecular weight non-cross-linked polystyrene.

13. The library of claim 1, wherein at least one compound in the library is a polypeptide, an oligonucleotide, or a sugar moiety.

Claims 14-25. (Canceled)

26. A chemical library comprising a plurality of member chemicals, wherein each member chemical is bound to a support, each support having associated therewith more than one population of semiconductor nanocrystals, each population having a distinct characteristic spectral emission,

wherein each nanocrystal comprises a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof.

27. (Original) The library of claim 26, wherein at least one member of the library is a polypeptide.

Claims 28-30. (Canceled)

31. The library of claim 26, wherein each nanocrystal comprises:

a core comprising a first semiconductor material; and

a shell layer overcoating the core, the shell comprising a second semiconductor material having a band gap greater than that of the core,

wherein the first semiconductor material and the second semiconductor material are the same or different.

32. The library of claim 26, wherein the characteristic spectral emission is a wavelength of emitted light, an intensity of emitted light, or both a wavelength and an intensity of emitted light.

33. The library of claim 26, wherein the each support is a bead, a pellet, a disk, a capillary, a hollow fiber, a needle, a solid fiber, a cellulose bead, a pore-glass bead, a silica gel, a polystyrene beads optionally cross-linked with divinylbenzene, a grafted co-poly bead, a poly-acrylamide bead, a latex bead, a dimethylacrylamide bead optionally cross-linked with N,N'-bis-acryloyl ethylene diamine, a glass particle coated with a hydrophobic polymer, or a low molecular weight non-cross-linked polystyrene.

Claims 34-36. (Canceled)

37. A library of polypeptides comprising a plurality of polypeptides, wherein each polypeptide in the library is bound to an individual support, each support having associated therewith more population of semiconductor nanocrystals, each population having a distinct

characteristic spectral emission and wherein each nanocrystal comprises a Group II-VI semiconductor, a Group III-V semiconductor, a Group IV semiconductor, an alloy thereof, or a mixture thereof.

38. The library of claim 37, wherein each nanocrystal comprises:

a core comprising a first semiconductor material; and

a shell layer overcoating the core, the shell comprising a second semiconductor material having a band gap greater than that of the core,

wherein the first semiconductor material and the second semiconductor material are the same or different.

39. The library of claim 37, wherein the characteristic spectral emission is a wavelength of emitted light, an intensity of emitted light, or both a wavelength and an intensity of emitted light.

(ix) Evidence Appendix

None.

(x) Related proceedings Appendix

None.